CONTRACT SERIAL NO: OGR 84-00355

CONTRACTOR: Centre for Frontier Engineering Research

REQUISITION NO: 23440-4-9135

CENTRE FOR FRONTIER ENGINEERING RESEARCH

NETWORKING PROGRAM FOR ARCTIC AND OFFSHORE ENERGY DEVELOPMENT

PHASE I PROGRESS REPORT MARCH 1984 TO AUGUST 1985

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MICROMEDIA

November, 1985

69pp

CENTRE FOR FRONTIER ENGINEERING RESEARCH
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EXECUTIVE SUMMARY

The Centre for Frontier Engineering Research (C-FER), supported by industry, governments and universities, was established in late 1983 to work on problems related to offshore structures and downhole tubular systems. Strong support was also evident for technology transfer activities: C-FER was therefore charged with a twofold mandate - Research plus Networking.

The Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources Canada, undertook support of a substantial segment of Networking activities over the initial three years. This report summarizes activities in the first half of this period and presents proposed plans for the next eighteen months.

The program of face-to-face industry contacts has been effective: continued emphasis will be placed on this activity. A suite of newsletters has been developed to supplement this direct contact. These are well received by the majority of contacts and are a useful tool for information dissemination. Several workshops have been run, in which participants shared common problems and solutions. While such workshops are constructive and worth continuing, additional emphasis will be placed on expert-led courses to effect technology transfer. With respect to establishing an information centre, C-FER is still proceeding cautiously, choosing to follow rather than lead user demand in this aspect of Networking. Other activities discussed include: the development of a research reporting system, the establishment of a "C-FER Atlantic" operation in Halifax, and the preparation of a "state-of-the-industry" overview.

Indications to date are that the C-FER Network is useful to its constituent contacts. However, C-FER must continue to listen closely to its Network clients in order to identify and meet their needs.

LE CENTRE DES RECHERCHES EN INGÉNIERIE DES RÉGIONS FRONTIÈRES

UN PROGRAMME DE DÉVELOPPEMENT D'UN RÉSEAU D'INFORMATION SUR LES DÉVELOPPEMENTS DE L'ÉNERGIE DANS L'ARCTIQUE ET LES RÉGIONS CÔTIÈRES

RAPPORT DES PROGRÈS DE LA PREMIÈRE PHASE DE MARS 1984 À AOÛT 1985

RÉSUMÉ DE L'EXÉCUTIF

Le Centre des recherches en ingénierie des régions frontières (C-RIRF), qui est appuyé par le secteur industriel, des gouvernements et des universités, fut établi à la fin de 1983 pour adresser des problèmes ayant trait aux constructions dans les régions frontières et aux systèmes tubulaires des puits. Les activités de correspondance en technologie ont aussi reçu un soutien. Le C-RIRF a donc été confié un double mandat: à savoir, de se charger des projets de recherche et d'organiser un programme de développement d'un réseau d'information.

Le Centre Canadien de la technologie des minéraux et de l'énergie, division du département Energie, mines et ressources Canada s'est engagé d'appuyer une partie importante des activités de développement d'un réseau d'information pour les premiers trois ans du programme. Le présent rapport fournit un résumé des activités déjà entreprises au cours de la première partie de cette période et introduit les plans projetés pour les prochains 18 mois.

Le projet d'établissement de communication directe entre industries s'est avéré efficace: on continuera à accorder une importance particulière à cette activité. Une suite de communiqués officiaux a été conçu pour compléménter ces rapports directs entre industries. Ces documents reçoivent un acceuil favorable de la majorité des contacts et s'avèrent des instruments utiles pour la propagation de l'information. Plusieurs ateliers ont été organisés; ceux qui y assistaient ont discuté des problèmes répandus de l'industrie ainsi que de comment résoudre ces problèmes. Bien que ces ateliers soient contructifs et qu'il vaut la peine de les continuer, l'accent sera mis sur des cours surveillés par des experts de l'industrie afin que l'on puisse effectuer les transfers d'information en technologie. Le C-RIRF demeure plus ou moins prudent quant à la mise sur pied d'un centre d'information. Pour ce qui concerne cet aspect du développement d'un réseau, sa préférence serait de l'établir selon les exigences des usagers plutôt que de mener le développement d'une documentation dans une voie prévue. Les autres activités qui ont été discutés comptent, entre-elles: le développement d'un système de diffusion d'exposés sur les recherches effectués, l'établissement d'une opération "C-RIRF-Atlantique" à Halifax, et la préparation d'un rapportage sur "l'état de l'industrie".

Jusqu'à présent, tout porte à croire que le réseau d'information du C-RIRF rend un bon service à ses constituents. Cependant, le C-RIRF aura intérêt à continuer de porter son attention sur la clientèle du réseau afin de pouvoir identifier leurs besoins et de les satisfaire de façon appropriée.

CENTRE FOR FRONTIER ENGINEERING RESEARCH

NETWORKING PROGRAM
FOR
ARCTIC AND OFFSHORE ENERGY DEVELOPMENT

PHASE I PROGRESS REPORT
MARCH 1984 TO AUGUST 1985

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CENTRE FOR FRONTIER ENGINEERING RESEARCH
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1.0 INTRODUCTION

In the early 1980's, representatives of the Canadian steel industry approached the Faculty of Engineering at the University of Alberta to discuss the initiation of research related to development of Arctic and offshore energy resources. Extensive dialogue followed between these and other interested groups. By late 1983 the concept had evolved of a research centre supported by industry, governments and universities. Further, broad support was evident for undertaking the dissemination of existing knowledge as well as the creation of new knowledge. When the Centre for Frontier Engineering Research (C-FER) opened its doors in 1984, it was therefore charged with a twofold mandate: Research and Networking.

Of the many supporters of the Networking initiative, among the strongest was the Canada Centre for Mineral and Energy Technology within Energy, Mines and Resources Canada. It undertook direct support of these C-FER activities through a three-year contract underwriting slightly more than forty percent of the staff, travel and support costs.

The contract (Requisition Number 23440-3-9212; Serial Number OST83-00427) runs from March, 1984 to March, 1987 and is broken into two halves. This report provides an overview of activities to date and proposes continued or modified efforts for Phase II.

2.0 OVERVIEW OF PHASE I ACTIVITIES

Specific activities for the initial eighteen months of work have been described in the interim progress reports submitted each month. This summary will deal on a broader basis with progress made towards establishing a viable Network, and with the philosophical directions established.

2.1 March to August, 1984

The first progress, likely the most important, was the transition of the Networking idea from concept to reality. The parent organization, C-FER, gained substance in the form of ten full time and contract staff members. The Principal

Investigator and the Research Officer assigned to the Networking project expended considerable effort in planning and undertaking the initial tasks. An Information Officer and a Secretary were recruited, to assist in building an effective Network. Such activity was key to a project which had spent many months as a "good idea": the Networking ball had begun to roll.

In the initial planning, two activities were identified as crucial to the success of the program: face-to-face contact with Network contacts (rather than impersonal mailings), and the use of project-oriented seminars to draw diverse individuals together.

Key individuals in the diverse industries which supply materials, designs and fabrication for facilities on Canada's frontiers were identified and then visited to explain C-FER's mission and to discover as much as possible about their organization and their perceptions of industry needs. A roster of approximately 100 contacts had been developed after six months activity, and was being updated as additional Network members were discovered or made themselves known. Client files were set up containing basic information on each organization (brochures, lists of projects completed and underway, etc.). The intensive program of "initial contacts" carried out over the first months would give way in the fall to a reduced program of "maintenance contacts" comprising client visits and exchanges at workshops. This effort to "stay close to the client" was and is regarded as an indispensable part of both the Networking operation and C-FER's commitment to emphasizing need-oriented research.

The second crucial activity identified at the outset was the bringing together of several Network members at project "post mortem" seminars. An important aspect of these gatherings was to be the technical information imparted to the participants; equally valuable would be the direct interaction, the Networking, between the individuals gathered. One important addition to this concept was the inclusion of small, less formal workshops, so that more gatherings might be held.

A third fundamental issue was not recognized at the outset but was resolved in the initial months. Upon investigating how C-FER might set up an electronic data base, it became apparent that this niche was well filled by some 660 publicly available data bases. A meeting was convened comprising several information specialists from various organizations in the Edmonton area. The concensus was that C-FER could best

contribute to its constituents by providing an information specialist who was expert in using those data bases pertaining to frontier projects, rather than developing an internal data base. C-FER took the fundamental decision that it would provide "information services" to its Network members, rather than a "data base" for the use of its Members.

While avoiding replication of large data bases available elsewhere, C-FER planned to assemble certain small, unique data bases, such as performance data on existing frontier facilities, or a catalogue of R&D performers working on frontier related projects. A modest start was made on the former base. Journals and publications were scanned and all references extracted which pertained to Arctic and offshore structures in order to identify owners, operators, commissioning dates, etc. The next step would be to ascertain the designers, fabricators and inspectors for each facility, who would then be contacted and requested to provide information on types of materials used, standards designed to, etc.

A number of research activities had significant Networking spin-off benefits, such as the participation of staff in CPA/CSA Task Forces, and collaboration between C-FER staff and faculty plus students at the U of A as research projects were developed.

Graphic design of the newsletters, brochures, report covers and stationery was harmonized so that each would be recognizable at a glance as originating from C-FER. As well, a coordinated suite of written communications was developed to keep in touch with Network members.

- Annual Report - published once yearly

- Newsletter
  - "Frontiers"
  - 3 issues annually, 6 or 8 pages
  - published quarterly between Annual Reports

- Current Awareness Update
  - "Networker"
  - 6 issues annually, 1 or 2 pages
  - published monthly between newsletters, excepting August and December

In summary, the first six months was a vital "building" period. A nucleus of top quality professionals was assembled. Several of the necessary Networking tools, such as the filing systems, the newsletters, and the brochure were developed. Key individuals in the majority of organizations which are important actors in offshore facilities were met and briefed on the objectives and activities of C-FER.

2.2 September 1984 to February 1985

The previous section summarized the initial period as one of "building" or preparation. The second six months can be characterized a period of consolidation, as plans were put into practice.

Face-to-face meetings with potential Network contacts continued at an intense pace into the fall, then dropped to a sustainable level of "maintenance visits".

A second major effort during this period was the development of a conceptual plan for a modest C-FER presence on the Technical University of Nova Scotia (TUNS) campus in Halifax. Discussions at all levels were very positive toward this proposal, which would see C-FER expand its operations to include Atlantic Canada in both its research and Networking initiatives. The proposal was endorsed in principle by the C-FER Board of Directors at its February 1985 meeting and was presented to the TUNS Governors for final approval.

A third initiative to move from concept to reality was the planning and production of two C-FER newsletters. Two issues of Frontiers, a quarterly forum (October and January) and three issues of Networker, a monthly update (November, February and March) were prepared during this six month period. Demand for Frontiers was high; nearly 1,000 copies of each issue of the 8-page, two-colour publication were distributed. Both publications were received with favourable comment from many quarters.

Several articles about C-FER were prepared for distribution to a variety of appropriate publications. A slide presentation was also developed to assist staff in explaining the organizational structure, research programs and Networking initiatives of C-FER to a variety of audiences. A free-standing display was prepared for use at conferences and exhibitions.

C-FER was represented at a variety of conferences; in all cases, interest in C-FER and its role in Arctic and offshore development was high. Such involvement resulted in many additions to the Network contact list.

Extensive discussion with some of Canada's leading northern and offshore information specialists, tempered by direction from the Board, resulted in a slowed pace for the development of C-FER's proposed Information Centre. This change in time-line reflected Board concerns relating to staff growth, but it in no way preempted C-FER's commitment to providing information services to Member and Network contacts.

Two workshops were held in January. The first centred on damage to steel plate in ice-resisting walls; the second, co-sponsored by the Welding Institute of Canada, brought together steel makers, welding consumable suppliers, and shipbuilders in a one-day session which focussed on the implications of fabricating low temperature steels. The approach of C-FER workshops continued to be toward facilitating interaction among various Network contacts, with a view to enhancing information exchange.

In addition, C-FER and the University of Alberta Department of Civil Engineering jointly organized a graduate level seminar "Offshore Structural Engineering." Registration for the twelve-week course far exceeded initial expectations, with a good mix of industry and university representatives.

The first full meeting of the C-FER Technical Council was held in October 1985. The panel of industry experts who provide guidance for and critical assessment of C-FER's research programs met with senior C-FER staff in Calgary. As well, several members of the Council met at the CANMET offices in Ottawa to give specific guidance to C-FER's "Welded Plate" project.

A third-year engineering student was hired for the Networking Project under the terms of the University's Co-operative Education Program. Her responsibilities included the assembly of a small, highly specialized data base on the five existing structures currently in the Beaufort Sea. Initial approaches to owners were made with a view to obtaining more detailed information, but considerable resistance was encountered with respect to releasing detailed information.

Co-operative efforts with various members of the University's Faculty of Engineering continued to increase. The professional expertise of research engineers in civil, mechanical and mineral engineering contributed greatly to C-FER's overall research and Networking initiatives.

2.3 March to August, 1985

During the third six month period, activities shifted from the startup mode to the operating mode. While systematizing the original activities, new initiatives were explored.

Industry contacts dropped to maintenance level, relative to the initial activity. Visits were generally made in conjunction with other trips. At the same time, increasing numbers of project-initiated contacts were being made by various C-FER staff, as the character of this mechanism evolved to be broadly-based within C-FER.

The Network contacts lists were transferred from a word processor to an IBM-PC. Because the latter hardware can accept relatively sophisticated data base software, the configuration will give much more powerful sorting and cross-referencing capabilities.

The 1984-85 Annual Report, which comprises C-FER's major reporting mechanism, was produced over the summer months. As this was the first full report prepared, considerable effort was invested in creating an informative and attractive presentation. Comments from many contacts indicate that it was well received in terms of both content and format.

The newsletters Frontiers and Networker continue to be published regularly. Despite earlier plans for only three Frontiers per year, a summer issue was prepared concurrently with the Annual Report. This made the workload doubly intense during June and July, and resulted in Network contacts receiving two communications within the space of a few days. In future years, the July issue of Frontiers will be omitted, being replaced by the Annual Report.

Enclosed with the July newsletter was a letter to each Network contact requesting address corrections if necessary. Also included in the letter was an invitation to terminate if the newsletters were not useful, with the intent of culling from the Network listings those who did not have an ongoing direct interest. Less than 5% of the recipients have chosen to terminate. Roughly an equal number added other individuals within their organization. This is interpreted as indicating that the newsletters are found useful by the vast majority of contacts.

A workshop was held in Calgary to disucss testing requirements for downhole tubular products. Senior drilling engineers from five major oil companies gathered to describe loading conditions and downhole environments typical of conventional, frontier and enhanced recovery wells. Testing needs were priorized. More specifically, these needs were translated into types and magnitudes of loads required to conduct the large scale investigations anticipated in the C-FER Test Facility.

The workshop "Northern and Offshore Information Resources" was held in Calgary during the first week of May. The meeting was attended by approximately 60 information specialists, librarians and end users from across Canada, and Alaska and other American states. Presentations were given on several of the key information resources, and intensive discussions held on improving retrieval and dissemination of the highly specialized information. The workshop was very well received: the participants recommended that it be held again in eastern

or Atlantic Canada in the fall. It was agreed that a summary of the proceedings would be published in the October issue of Frontiers.

A second meeting of C-FER's Technical Council was held, in which more than a dozen technical specialists gathered to review research project proposals in the general program area of Downhole Tubulars. The one-day session resulted in one project being accepted, one being returned to C-FER staff for fine-tuning before implementation, and one being judged of interest to too narrow an audience to pursue as a core research project. As well, a meeting of a Project Committee was held to provide technical direction for the "Welded Plate" project.

C-FER staff continued active participation in the CSA Offshore fixed Platform Standards Task Forces and the Marine Advisory Board (Arctic).

Cataloging of the small C-FER library was started, using a librarian on an hourly contract to establish the system and format, and to initiate listing of publications. The highly specialized library will contain technical reports not readily accessible elsewhere (so-called "grey literature") as well as pertinent reference material, conference proceedings, etc., needed frequently by C-FER staff. The listing format developed for C-FER is compatible with, but not as sophisticated as, the one used by OEIC (Ocean Engineering Information Centre of C-CORE) and ASTIS (Arctic Science and Technology Information System of AINA).

Publicly available information (technical papers, etc.) regarding the five existing Arctic structures were collated to form the basis of a small, specialized data base. However, efforts to obtain more detailed properitary information, such as structural drawings and specifications, were not successful. Development of this data base was suspended until a more effective approach can be established.

A general survey paper, entitled "An Introduction to Canadian Frontier Oil and Gas Development" was completed by the engineering co-op student. Written to capture C-FER's overview of the offshore-structures-related design technologies and fabrication industries, it will also provide a framework or context for comments regarding gaps in existing technology.

The Board of Governors of the Technical University of Nova Scotia formally approved the establishment of a small "C-FER Atlantic" on their campus. This operation, initially to be comprised of a Network Officer/Manager and two TUNS Faculty members who will devote their research time to C-FER projects, was scheduled to open its doors at the beginning of September.

However, delays in moving the previous occupants out of the new C-FER Atlantic offices slowed the startup process. This initially modest operation will expand only as local demand - and support - are built up.

Another initiative was a start on a project reporting system, whereby brief monthly reports for each core project are to be sent to interested technical contacts within Member companies. This is detailed Networking, moving current information on the various projects out to those who have a direct interest, and conversely, soliciting constructive suggestions on an ongoing basis from the same audience. The first stage in the process was careful definition of the projects, grouping of like activities, and identifying the interested technical specialists for each project. Report writing responsibilities were assigned to individual project officers, and "Rationale" and "Objectives" statements were prepared for each project.

2.4 Technical Audit

A Technical Audit of the Networking Program was held in late September after being postponed in August due to unavailability of some participants. A small group of experienced professionals (listed on Table 1) reviewed C-FER activities, to provide external feedback on what has been effective and what might be improved. Thoughtful and challenging comments were provided by the participants, making this an extremely useful exercise. Summary comments respecting each activity are contained in the relevant subsections of Section 3.0.

TABLE 1

TECHNICAL AUDIT
REVIEWERS

K. Glegg	Vice President, Technology Transfer National Research Council of Canada
R.A. Hemstock	(of A.P.O.A., A.P.E.G.G.A. and C.C.P.E. fame)
J.T. Jubb	Deputy Director General Physical Metallurgy Research Laboratory CANMET
J.C. McKay	Director, Research and Development Stelco Inc.
I.E. Williams	Group Sales Manager Fabrication and Heavy Manufacturing Algoma Steel Corporation Limited

3.0 DISCUSSION OF ACTIVITIES

3.1 Industry Contacts

One of the cornerstone concepts of the C-FER Network is that it be comprised of individuals, not organizations. Face-to-face contacts were initiated in spring of 1984, continued at an intense pace into the summer and fall, then dropped to a sustainable level of "maintenance contacts". Of all the Network-building activities undertaken by C-FER, this one has required the greatest effort. It has also paid the greatest dividends. Individuals are much more open in personal discussions regarding the capabilities and activities of their organizations. Brochures and papers are obtained immediately, as opposed to having a letter request stagnate in the in-basket. Follow-up telephone contacts are made much easier by having an initial personal meeting.

Two administrative tools have been developed to support this activity:

a) Client Files

These are a repository for information on experience and capabilities of Network contacts. Organized by companies or institutions (rather than by individuals), the files typically contain brochures, annual reports, staff resumes, and notes on equipment and facilities. This represents a significant collection of data about frontier related industries and research performers.

b) Network Listing

Now containing approximately 700 names, the list is comprised of three basic categories:

- Network Contacts - individuals with a direct technical interest within C-FER's technical mandate (225 names)
- Friends of C-FER - individuals who have general interest, or who hold management rather than technical positions (375 names)
- Media Contacts - various print and electronic media (100 names)

The list is keyworded in several basic areas of interest:

- activity type (designer, researcher, etc.)
- project type (offshore structure, pipeline, etc.)
- material type (steel or concrete)
- project location

Management of the list is achieved through a small data base program on a personal computer. The Network contacts can be sorted by any of the name or address items, or by any combination of key words. A sample segment of the list is attached in Appendix A.

In addition to the on-site visits, a number of techniques have aided in developing industry contacts. A display was prepared and exhibited at several conferences and trade shows: high levels of interest were evidenced by high demand for C-FER brochures and newsletters on display. Approximately half a dozen articles were specifically prepared for publication in various technical periodicals. These have triggered enquiries about research projects and the Network, and have generally raised C-FER's profile as a focal point for technology transfer. Formal advertisments inviting individuals to join the Network proved ineffective as few reponses were received. Talks and slide presentations have been given to a variety of technical and non-technical audiences, again with the objective of raising C-FER's profile as a centre of excellence. While these techniques clearly contribute to the building of a Network, personal contacts remain the most effective approach.

3.2 Publications

Another important tool for disseminating information through various industry segments are the newsletters. They are sent, on essentially a monthly basis, to all individuals on the Network list. These written communications are intended to supplement rather than supplant personal contact as the basic Networking tool. The newsletters provide a relatively low cost means of staying in touch with the numerous contacts on a regular basis.

The purpose of the newsletters is a dual one:

a) to assist with the dissemination of news of general interest to various frontier-related industries.
   - notices of joint industry proposals, etc.
   - new products, programs or processes
   - "success stories" and awards to Canadian firms
   - conference notices, calls for papers

b) to act as a vehicle for C-FER communications
   - brief descriptions of ongoing research
   - reports available
   - staff appointments, profiles on researchers

Emphasis is placed on the former goal: approximately 70% of each issue is devoted to industry news, while the balance is C-FER news.

A two-tier set of newsletters has been developed, with a "higher effort" edition (Frontiers) being published quarterly and a "lower effort" edition (Networker) being published monthly in between, as shown in Table 2. Examples of each may be found in Appendix B. When formulating the original plans for the newsletters, C-FER wished to stay in touch on a monthly basis, but was advised by other organizations that a reasonable quality newsletter on a frequent basis was an exceedingly ambitious undertaking. Plans were accordingly scaled back to the two-tier approach: this has proven to be an appropriate level of effort to invest in written communication.

Table 3 provides an indication of the relative work and expense in producing each version of the newsletters.

The 1984/85 Annual Report, being the first full report published, received extra consideration in the context of organizational accountability. It was decided that the Annual Report should be more than a barebones document serving only to satisfy legislative requirements. The concept was expanded to incorporate a complete Research Report, which documented in some detail the evolution of the various project directions. Membership and Networking Reports outlined progress in those respective areas. In addition to the enhanced content, extra effort was invested in developing an attractive layout so that the information would be read. Because research progress is, in general, measurable in yearly or longer increments, the Annual Report is seen as being a major accountability mechanism.

Discussions at the Technical Audit have led to efforts to focus the content of each tier more clearly. Notices, announcements, etc. of current interest will be channelled to the Networker. Frontiers will contain articles of more lasting technical interest, and will be targeted to be kept on the recipient's bookshelf. Consideration is being given to the establishment of a column which would profile Network contacts, thereby enhancing recognition of Canadian expertise.

TABLE 2

NEWSLETTER PUBLICATION SCHEDULE

Frontiers	January	
	February	Networker
	March	Networker
Frontiers	April	
	May	Networker
	June	Networker
Annual Report	July	
	August	-
	September	Networker
Frontiers	October	
	November	Networker
	December	-

TABLE 3

NEWSLETTER PUBLICATION
(effort per issue)

	Frontiers	Networker
Preparation of articles editorial input, layout	10 person days	2 person days
Typesetting, printing, distribution	$3,000	$500
Notes	typeset, printed, pictures, magazine writing style	typewritten, photocopied, no pictures, point form writing style

3.3 Workshops

A significant number of conferences occur each year which touch on areas of technical interest to C-FER. It was therefore decided that a more useful niche to fill would be the provision of highly focussed workshops on technical areas too narrow to attract conference attention. Thus the large, organizationally difficult and financially risky conferences would be left to others.

Four such workshops were held during Phase I. These are described in Appendix C.

Another initiative which exemplified C-FER's commitment to collaboration between industry and university communities was a joint effort with the Department of Civil Engineering. A twelve-week graduate-level seminar, "Offshore Structural Engineering", drew more than 40 registrants from both university and industry to hear some of Canada's leading experts in offshore structures: the lectures were given by specialists from Canadian operating and consulting companies. A full set of notes was prepared by a graduate student and distributed to participants.

Considerable discussion on the topic of workshops occurred at the Technical Audit. The concensus was that, while the low-key workshops were a worthwhile way of exchanging information among the participants, something more could be achieved. The reviewers suggested a higher level workshop in which national or world experts would be brought in to give a focussed course on some relevant topic. This was contrasted with conferences, which tend to cover a number of diffuse topics, and with the initial "participant-led" workshops, which tend to be exchanges of information rather than high-technology transfer.
A spinoff benefit of bringing world class experts into Canada is that they will usually stop and visit others in their field.

Another point made was that a test of true value in the provision of workshops was the recovery of all costs (i.e. direct room charge, etc. plus indirect organizing expenses). The first three workshops had been run on a no-cost basis, while the fourth had recovered room, luncheon and travel costs for the speakers. The cost-recovery approach will be adopted with the "expert-led" type workshops.

3.4 `Information Service

In the planning stages of the Networking program, another tool intended to facilitate the flow of technology was an "information service", which would act as the focal point for queries and data within C-FER's areas of technical interest. The objective was to have a visible, accessible centre which was clearly perceived by industry as "the" place to obtain information. Role models were such venerable establishments as the Ocean Engineering Information Centre at C-CORE and the Canadian Institute of Steel Construction.

One early decision taken was that C-FER would not develop a bibliographic data base focussed on frontier engineering. Some 660 data bases were publicly available in 1984. While only a handful of these related to C-FER's mandate, and while none focussed explicitly on the mandate, it was apparent that this field was well serviced. A more specialized strategy was developed: identify the data bases relevant to the needs of C-FER and its Member companies, and become expert in using them. In this way, C-FER would act as a "gateway", assisting users to effectively access the masses of information that already exist.

Some exceptions to this policy are anticipated, however. C-FER may undertake the development of small, specialized data bases within its technical mandate and not available elsewhere.

As a corollary to the policy respecting bibliographic data bases C-FER will not, in general, acquire and hold references which are available from others (for instance, the University of Alberta Library). However, a small, specialized library is necessary to contain books and references frequently required by C-FER staff for their projects and reports, or conference proceedings, etc. not readily accessible elsewhere (so called "grey literature").

Cataloging of the library holdings is being done on a computer, rather than a card index. A relatively simple format was chosen:

- title
- authors
- source and date published
- location code (for shelving)
- subject keywords
- abstract

Appendix D contains a sample of the library listing.

This simple approach minimized the expense and potential for error in cataloging and maintaining the library. However, if simplicity was virtue, so was compatability - the only question being, "compatible with what?" Even the few data bases relevant to C-FER each had a different format. It was decided to use a simplified version of the Arctic Science and Technology Information System (ASTIS) for two basic reasons. First, their system appeared exceptionally well thought out and complete; second, they are a closely allied organization which is already collaborating with our sister organization, C-CORE. The ASTIS listing contains 28 bits of information and the C-FER listing six, but common bits are identical in format and style.

Some discussions occurred at the Technical Audit on the cost/benefit of the abstract contained in the listing. Advanced researchers can generally judge the usefulness of a reference by author and title alone since they are familiar with others in their field. Nevertheless, the concensus was that the abstract was useful and necessary data.

Because no preexisting workload of enquiries from Member companies or Network contacts created high demand, C-FER has proceeded cautiously in recruiting a staff librarian or information specialist. The initial cataloging for C-FER's library is being carried out by a part-time contract person. The next step will be to engage a continuing part-time librarian or a Library Science student to provide a modest in-house capability. A full-time staff member will not be recruited until the workload warrants this step.

Another activity which is proceeding slowly, although not by intent, is the development of a data base of information on structures and icebreakers currently operating in the Arctic. This was intended as a small start on describing actual and proposed structures for all of Canada's offshore frontiers. All publicly available information was gathered from papers, brochures and articles. A precise engineering description of each structure was then requested from the respective owners: structural drawings; fabrication specifications; grades, tonnages and locations of steels used. At this point progress slowed, because the owners perceived more risks than advantages in releasing their data, even with assurances of confidentiality from C-FER. An alternate strategy has since been adopted, whereby C-FER will continue to collate as it becomes available, but will not be proactive in requesting proprietary information unless a specific need arises with respect to a research project.

3.5 Research Reporting

One specific application of the Network is the gathering of research needs and the dissemination of results.

C-FER's research plan is defined primarily by Member companies, with input from Network contacts and C-FER staff. These needs are then channelled to the Research Policy Committee, a standing committee of the Board of Directors charged with responsibility for C-FER's overall research program. Working closely with this Committee is the Technical Council, a panel of industry experts representing all Member companies. The Council meets twice a year, providing guidance for and critical assessment of C-FER's research projects. Reporting to the Technical Council are a number of Project Committees, formed as necessary to steer the progress of each specific research project.

Equally important is the flow of information back to those who initiated the project. The Network has taken on this role, to stimulate detailed technical discussion among those with an interest in the particular problem which the project is addressing.

For each project which is sufficiently active to have a Project Committee, the C-FER Project Officer prepares a brief Monthly Report which summarizes current activities. Members of the Project Committee receive this report and are encouraged to call the Project Officer with questions or suggestions. For contract projects, only the Client Representative receives the Monthly Report. General overview reports are provided to all Network contacts from time to time through newsletter articles.

Two additional documents are developed at the outset, and updated as required during the course of a project:

a) Project Rationale

   A brief statement explaining the technical and economic importance of the problem which the project will address and an estimate, if possible, of the benefits (environmental, safety or economic) which will result from a successful project.

b) Project Objectives

   A few concise statements describing the anticipated outcomes, products or knowledge to be developed through the project.

These documents state succinctly and lucidly the importance and goal of each project, and are reviewed at least annually by the Technical Council as a whole.

Examples of a Project Rationale, Project Objectives and Monthly Reports are attached in Appendix E.

In addition to providing a major mechanism of accountability to the end users of C-FER research, the reporting system is also designed to stimulate an ongoing dialogue between researcher and user.

3.6 C-FER Atlantic

Another extension of C-FER's commitment to collaboration is C-FER Atlantic. This initiative will see C-FER actively engaged in both research and Networking from the campus of the Technical University of Nova Scotia (TUNS) in Halifax. Research efforts will be focussed initially on downhole tubular technology related to the Atlantic offshore.

Benefits from such an initiative will extend beyond Atlantic Canada, however. Clearly, such a move will underscore C-FER's presence as a national endeavour. At a provincial level, the collaborative approach to downhole tubulars research will be of great benefit to the many energy companies based in Western Canada, both in frontier and conventional environments. At the national level, C-FER's increased expertise in the structures and environment of the east coast (substantially different from those in the north), will round out its research effort, thereby making it better able to offer the services of a world-class centre of excellence.

Some activity started during the summer on an informal basis. Two TUNS staff members, Dr. G.M.C. Lee and Dr. K.G. Leewis, have been reviewing design standards for casings, and have hired a C-FER subsidized student to assist them in preparing a report. These two gentlemen also participated in the Technical Council meeting of 1985 05 07. They are actively seeking specific research projects in which they can become involved on behalf of C-FER Atlantic.

The genesis of the C-FER Atlantic concept was unique in that it was based on preexisting relationships (the Principal Investigator is a TUNS Alumnus). Some cautions were expressed at the Technical Audit, generally related to amount of energy required to develop an effective organization at long distance. The basic idea of establishing ongoing relationships with universities was strongly supported, but it was noted that there may be less effort-intensive linkages than establishing a satellite office. Specifically, it was suggested that no additional venture be undertaken in this format until all the "bugs" are worked out of the C-FER Atlantic operation.

3.7 "State of the Industry" Overview

One of the tasks of the Networking program is to identify technology gaps and other factors mitigating in favour of foreign performers (i.e. against Canadian industry) in the award of design and construction contracts for frontier structures. This was perceived at the outset as a much smaller task than it now appears. However, a start has been made with the preparation of the paper "An Introduction to Canadian Frontier Oil and Gas Development". It describes, in a general way, the unique challenges presented by Canadian frontiers, the design responses that have evolved, and the Canadian industries which design, build and operate structures on these challenging frontiers.

The paper is an attempt to put the various components of frontier structures technology into context with each other. The paper is also a first iteration of a longer process: the very general descriptions in each section will be enhanced by requesting specific comments from industry experts. The paper will thus evolve into a collection of authorative opinions on the multi-faceted technologies and industries.

The transition from a "state of the industry" overview to a "state of the art" description of current leading edge technology and knowledge gaps is an enormous task, for a huge breadth of very detailed knowledge is required. Virtually the only way to capture this kind of knowledge is to assemble the expertise of specialists from each field. The intimidating size of this undertaking was confirmed by experiences of the various reviewers at the Technical Audit. While significant benefits were anticipated from a definitive "state of the art" description, high costs were foreseen as well. Caution was expressed that this single task could consume a disproportionate amount of the Networking Program resources.

The solution to this problem lies in focussing C-FER's efforts on the areas in which the organization has expertise, namely the structural design of offshore structures and downhole tubular systems. Definition of the "state of the art" in related areas, such as materials or fabrication, will be left to others. Technology gaps within C-FER's area are already being defined in a very pragmatic way as research project needs are identified. These needs are user-defined, through the Technical Council, rather than researcher-defined, and therefore represent an industry concensus.

An additional suggestion made at the Technical Audit was that C-FER co-sponsor a "state of the art" study with other organizations. This has appeal, but it is still felt that this should be approached on an as-time-permits basis so as to not divert efforts from other Networking activities.

3.8 Networking Program Goals

In the initial organizational stages of the Networking program, a very broad goal statement was formulated. As shown in Table 4, it attempted to place C-FER's activities into context with industry activities and national objectives. Some concern was expressed by the reviewers at the Technical Audit that this goal statement was too general to be useful in setting priorities and measuring progress. Therefore, while those goals are still felt to be valid in a conceptual sense, the objectives of Phase II have been outlined in a much more detailed way.

TABLE 4

NETWORKING PROGRAM GOALS

Canada

- Improve competitive position of indigenous industries
  - improve information flow between industry segments
  - improve awareness of Canadian capabilities
  - focus research efforts through improved liaison between industry and research performers

Industry

- Establish easily accessible information centre
- Independent assessment of knowledge gaps
- Facilitate exchange of views and act as a clearing house for technical problems
- Improve coordination of R & D efforts

C-FER

- Become recognized as a useful centre
- Establish "Listening Posts" in various industry segments
  - identify opportunities for C-FER
  - avoid redundancy with other performers

4.0 SUMMARY OF C-FER EXPERIENCE IN ESTABLISHING A NETWORK

This section attempts to capture the rationale of several of the decisions that appear to have set the C-FER Network on a useful path, and to provide comments that will assist in starting up other networks.

At the outset, a quick search was conducted to find a good role model. Networks that were identified as such generally fell into one of three categories:

a) circumstance driven - for instance, when an industry association or government body had some research funds to dispense a cadre of interested individuals and organizations quickly gathered. Network contacts were highly motivated and information flow occurred in both directions (problem statements vs. proposals and reports). This type of network could be effective, but lasted only as long as the circumstances.

b) personality driven - where an individual acts as a "linker" between different parts of the network, either on the basis of encyclopedic technical knowledge or an interest in technology transfer. This type of network appeared to be very durable, surviving changes in both circumstance and geographic location of the "linker".

c) need driven - is distinguished from circumstance driven because the needs originate within the contacts themselves, rather than opportunities being presented from without. For instance, the need of members of the Arctic Petroleum Operator's Association to share the high expense of common research projects, or members of the Canadian Petroleum Association to lobby with one voice, or the offshore structures industry to develop design guidelines through the Canadian Standards Association. Need driven networks generally last only as long as the need does, although they can be durable if they adapt to changing demands.

In addition to networks that were explicitly recognized as such, numerous informal networks existed as spinoffs from whatever principal technical activity in which the individual or organization was engaged. Generally combinations of need and personality driven, these were highly effective. However, they were not regarded as good role models because their usefulness "just happened" rather than being managed.

While the C-FER situation did not fall clearly into any of the three categories, some useful philosophical directions were garnered.

First, it was realized that knowledge transfer takes place through interested individuals. The meant that the C-FER Network should be comprised of persons - not organizations, and not anonymous titles (like "Manager, Engineering Services"). The "interested" part implied that mass membership would not be generated by copying mailing lists from other organizations. A small, interested Network was anticipated (and has proven) to be superior to a large mailing list of contacts with uncertain motivations.

Another important corollary of the individual-oriented Network was a commitment to some level of human contact. The initial round of face-to-face meetings was very time consuming; the ongoing program of maintenance contacts takes a significant fraction of staff resources. However, the dividends of greater understanding of needs and greater openness in communication make the effort well invested.

The newsletters have proven to be a very useful communication tool supplementing the personal contacts. It was believed important to keep in touch on a relatively frequent monthly basis, in order to supply current information and to maintain a continuous presence in the frontier-related industries. However, original plans called for ten issues of a Frontiers type newsletter per year. C-FER was advised by other organizations that this was overly ambitious: the figures in Table 2 (Section 3.2) evidence this is correct. The level of effort involved in meaningful newsletter production is easily underestimated: care must be exercised to undertake this task at a level which is sustainable over time.

While information transfer is clearly a laudible goal, literally dozens of agencies collect and make available great volumes of data. These range from private and public electronic bibliographic data bases, through numerous weekly and monthly trade journals, to industry associations. The C-FER experience shows that considerable effort must be expended to even determine if an unfilled niche exists. Two strategies that appear to have more potential than gathering information are: digesting data available from others and focussing it on the needs of the specific network; and assisting network contacts to access the data they need in an efficient way. Even these services are well covered by existing operators in many fields: it may be more expedient for a networking agency to subcontract information-type activities than to undertake them internally.

The effectiveness of the central node in a network depends upon the perception of the various contacts that it is a useful focal point. In the longer term, of course, this perception will be contingent upon the provision of a truly useful service. The short term problem is to raise general consciousness that the central node is going to play that role. Therefore, one of the early tasks in establishing a network is to develop a public relations program to advertise the presence of the central node. This is similar to the product initiation programs used by private sector firms at the beginning of the marketing cycle. Without such a public relations effort, constituent acceptance of the networking effort will likely be relatively slow or haphazard. Again, it is emphasized this is a short-term consideration: long-term acceptance is based on providing true value, on developing a credible track record.

The development of an acceptable (preferably excellent) track record as a networking organization depends almost entirely upon identifying the needs of contacts and responding to them. Developing either circumstance driven or personality driven networks is a matter of serendipity, and is by-and-large not a manageable process. Setting up a new network therefore likely implies a need driven network. This organizational process can be made more certain of success by three initial activities.

First, a specific, useful task should be developed for the network to undertake, a task defined by the users. This goes beyond the usual "well defined mandate" and gives the network some small raison d'etre which will be immediately accepted by its constituents. It is much easier to build incrementally upon success than to winnow the effective activities from a range of initiatives. Furthermore, any organization with no previous track record has a vested interest in doing the initial few tasks very well - this is more likely to happen (and be perceived as happening) if the network contacts are actively supportive rather than being neutral or skeptical.

The second crucial activity occurs at the staffing stage. It is impossible to have a need driven network unless the individuals managing it are committed to serving the clients. Therefore, one hiring criteria should be a proven client orientation. (It is presumed that staff members would be supported in this approach by a properly formulated mandate and by appropriate policies.)

Thirdly, a small advisory board should be established. The primary purpose would be to assist in discerning user needs, so the majority of the members should represent network clients. Another important purpose would be to capitalize on the experience of similar or related organizations, so one or two board members should be drawn from that direction. The advice given to C-FER by the reviewers at the Technical Audit has proven very useful, even on a one-time basis.

5.0 PROPOSED WORK PLAN FOR PHASE II

Activities anticipated in Phase II are essentially a continuation of initiatives developed over the initial eighteen months. While no radical shifts are proposed, those activities which are seen as being effective have been emphasized, while other activities have been relegated to an as-time-permits status. Thus, Phase II will focus efforts and refine the objectives established at the outset.

Detailed goals and objectives for Phase II are outlined in Appendix F. The wording for these statements has been made quite specific, to assist in translating the goals to operational priorities. The following section presents background and rationale, in order to flesh out the brief statements in Appendix F. Section 5.2 discusses the reasons for deemphasizing some activities.

5.1 Phase II Goals and Objectives

The benefits of personal meetings with existing and potential Network contacts are seen to be more than worth the effort involved. Therefore, an ambitious program of maintenance contacts and new contacts in the downhole tubulars area has been set out.

One very successful technique used by the Canadian Steel Industry Research Association (CSIRA) to attract the research attention of academic investigators was the provision of small contracts providing travel funds for overseas technical visits. The efforts of the investigators were focussed on a CSIRA-defined problem, and these efforts were leveraged through graduate students and associated funding from the Natural Sciences and Engineering Research Council. C-FER will design

and implement a program to achieve similar results in "frontier" technology.

Networking contacts will be extended by seeking out and bringing into the Network those individuals who are chairmen of relevant technical committees within such organizations as the Canadian Petroleum Association, the Canadian Standards Association and the Canadian Society for Civil Engineering. Similarly, formal links with relevant research organizations will be sought, to enhance the already existing but informal working relationships.

With respect to the publications, efforts will be invested primarily in identifying and implementing improvements in content and format, to better serve the readers.

The C-FER brochure will be updated. This is a useful handout in conjunction with the conference display, and an efficent way to answer standard enquiries about C-FER or the research programs.

In order to be an effective focal point for information transfer, C-FER must be perceived as such by the industries it serves. Publication of technical articles in current trade journals is designed to bring to the attention of industry the role that C-FER is playing. Dissemination of highly technical results through papers in learned journals also contribute, but in a longer time frame.

The participant-led workshops which C-FER has sponsored over the past year and a half have been useful, and will be continued as suitable opportunities arise. An example of this is "Northern and Offshore Information Resources" which will be repeated to meet an expressed demand. As well, where need exists for the exchange of technical information among different components of the Network, C-FER will sponsor or stimulate such an exchange. This vision has been extended by the addition of expert-led workshops. Some effort will be rechannelled from "sharing" type workshops to these more organizationally difficult, less frequent but possibly more valuable "learning" type workshops. A preliminary target has been established: one of each type of workshop per year. However, the two types are felt to be interchangeable if expressed demand is for two of one type or the other, rather than a mix in any one year.

Similarly, the university course co-sponsored with the Department of Civil Engineering was seen to be very successful, so similar efforts will be mounted in the future. The next course will likely be in the area of downhole tubulars, so a

pilot series of speakers will be run in the spring term, before a full course is established.

As well as enhancing industry perception of C-FER as a central "node" in the Network through technical articles, two additional approaches will be used. The conference display will be updated and put to work on a more systematic basis. As well, opportunities will be sought for staff to give verbal presentations to technical societies, etc., in order to raise C-FER's profile among those not reached by normal avenues.

The C-FER library has been initiated using ad hoc contract services. This will be formalized, although still at a relatively modest level, by upgrading to a continuing part-time staff capability.

A research reporting system was developed in Phase I, but implemented only on a pilot scale due to time constraints. This initiative will be moved forward for all active projects. The usefulness of the system to the Project Committee Members will be monitored, and modifications made over the spring months.

The state-of-the-industry paper prepared by the engineering co-op student comprises a good base upon which to build. The general sections will be upgraded by requesting specific comments from relevant industry experts, within the framework of the overall paper.

5.2 Initiatives Deemphasized in Phase II

One of the specific techniques that was to be used to assess the relative importance of technical issues in the design and fabrication process was the vertically integrated analysis of a completed project. C-FER has been unable to come up with a way to approach this such that successes will not be overblown and difficulties hidden. Discussions with others indicate similar difficulties with this type of approach. It is still believed that the vertically integrated analysis has merit, but alternatives are being sought to replace the "project post mortem" approach.

One of the principal mid-course corrections within the Networking program has been with respect to the setting up of an information service. It was originally envisaged as an activity that would draw enquiries to C-FER, thus establishing it as a focal point. Reassessment has indicated that demand for such a service will likely build slowly, both within C-FER and externally. Therefore, the pace has been slowed at which the library is being developed, links with bibliographic data

bases are being established, and information specialist capability is being brought on staff. C-FER will follow rather than lead demand in this aspect of its Networking.

Some difficulties were encountered in persuading owners of Arctic offshore structures to release information regarding their structures. While a central repository of engineering data was seen as being a good idea, it apparently was not sufficiently beneficial to warrant the work and/or risk in disclosing heretofore proprietary data. C-FER will not aggressively pursue this information but will collect and collate it as it becomes available.

Another specialized data base contemplated by C-FER was a listing of relevant research projects and researchers. This is still seen as very useful, but work on this initiative has been deferred to make way for some of the activities outlined in the previous section.

One of the initial hopes for the Networking program was that it could establish a complete, balanced overview of the current state-of-the-art for offshore structural design and fabrication. As discussed in Section 3.7, the breadth of this task and the resources required to complete it in a definitive fashion outweigh the perceived benefits. It has been assigned an as-time-permits priority.

6.0 CLOSURE

The establishment of an effective technical Network "from scratch" has been a unique experience because no readily applicable precedents existed. This report presented the account of activities undertaken and the rationale for doing so. It was written in some detail in the hope that this experience will be of benefit to others who are charged with a similar task.

Early indications are that the Network is useful to its constituent contacts. The vast majority chose to stay on the list when offered a chance to discontinue. The newsletters are of good quality, in terms of both format and content. While difficulties have been encountered in obtaining certain proprietary data, Network contacts are generally open and helpful in answering specific questions. Information exchanges which have occurred at the participant-led workshops held to date are acknowledged as being constructive and timely.

These are positive signs, but a longer term view must be taken in judging the overall success of the Network. To achieve durability, the C-FER Network must continue to listen closely to its constituents and continue to adapt as needs change. This commitment exists within C-FER - and, encouragingly, it appears to be matched by the commitment of many contacts to participate in an active way in shaping the Network into an effective tool.

APPENDIX A

NETWORKING LIST

C-FER NETWORKING LIST
KEYWORD INDEX

ACTIVITY TYPE

FABR	Fabricator
GREG	Government/Regulatory
MATS	Material Supplier
ODES	Designer - Other
OWOP	Owner/Operator
RCHR	Researcher
SDES	Designer - Structural
LIBR	Librarian
PUBL	Publication
TDES	Designer - Tubulars & Drilling

PROJECT TYPE

ANST	Ancillary Structures
PIPE	Pipelines
SHIP	Ships/Barges
STRC	Offshore Structure
TBLR	Downhole Tubular Systems
TOPS	Topside Components

MATERIAL TYPE

CONC	Concrete
STCN	Steel - Canadian
STFR	Steel - Foreign

PROJECT LOCATION

ARTC	Arctic Islands
BEAU	Beaufort Sea
GBKS	Grand Banks
LBDR	Offshore Labrador
SCSH	Scotian Shelf
WCST	West Coast

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LIST TYPE

FRND	Friends of C-FER
MDIA	Media Contacts
NETW	Network Contacts
MBOD	Member - Board of Directors
MMBR	Member - Membership Committee
MNOM	Member - Nominating Committee
MRPC	Member - Research Policy Committee
MTCL	Member - Technical Council
CFER	Official Contact Person - C-FER Member Companies
TITL	Identifies those contacts whose title or other special circumstances preclude automatic printing of a mailing label.
CONTACT DATE	Date of last contact by letter or visit (YY MM DD) (blank if no entry)

NOTE: Maximum of 5 Type codes per line.

A.D. Williams Engineering Ltd.
Twin Atria Building
Suite 106, 4999 - 98 Avenue
Edmonton, Alberta
T6B 2X3

Mr. G.W. Devine , P.Eng.
Manager,
Structural Engineering

(403) 468-2512

Activity Type:	SDES
Project Type:	ANST
Material Type:	STCN, CONC
Location Type:	BEAU, ARTC
List Type:	NETW

A.L. Burwash Consulting
#326, 510 Fifth Street, S.W.
Calgary, Alberta
T2P 3S2

Ms. Anna Burwash

(403)266-1137

Activity Type:	
Project Type:	
Material Type:	
Location Type:	
List Type:	FRND

AASAU Office
347 Athabasca Hall
University of Alberta
Edmonton, Alberta

Mr. G. Unger
Executive Secretary

Activity Type:
Project Type:
Material Type:
Location Type:
List Type: FRND

Acres Consulting Services Limited
#500, 10201 Southport Road, S.W.
Calgary, Alberta
T2W 4X9

Mr. C.R. Beresford

(403) 253-9161

Activity Type: SDES
Project Type: STRC, PIPE
Material Type: CONC, STCN, STFR
Location Type: ARTC, BEAU
List Type: NETW

Acres International Limited
5259 Dorchester Road
P.O. Box 1001
Niagara Falls, Ontario
L2E 6W1

Dr. D.H. MacDonald
Senior Vice President

Activity Type:
Project Type:
Material Type:
Location Type:
List Type: FRND

Acres International Limited
44 Torbay Road
St. John's, Newfoundland
A1A 2G4

Mr. R.J. Gill
Project Engineer
Arctic and Offshore

(709)754-1710

Activity Type: SDES
Project Type: STRC, TOPS
Material Type: STCN, STFR
Location Type: GBKS
List Type: NETW

Acres International Limited
480 University Avenue
Toronto, Ontario
M5G 1V2

Dr. A.B. Cammaert
Manager,
Arctic & Offshore Services

(416) 595-2071

Activity Type:
Project Type:
Material Type:
Location Type:
List Type: FRND

Acres International Limited
5259 Dorchester Road
Niagara Falls, Ontario
L2E 6W1

Mr. R.G. Tanner
Manager, Ocean and Marine Services
Transportation Division

(416)354-3831

Activity Type: SDES, ODES
Project Type: STRC, PIPE
Material Type: STCN, STFR, CONC
Location Type: SCSH, GBKS, ARTC, BEAU
List Type: NETW

APPENDIX B

NEWSLETTERS

Centre for Frontier Engineering Research

Frontiers

A quarterly forum *Volume 1, Number 4, July 1985*

C-FER test coupons on a C-NAMAR supply vessel

CFER

Downhole Tubulars Research Expands

Representatives of Canada's leading oil companies met with designers, engineering consultants and senior C-FER research staff at a recent meeting of the C-FER Technical Council to review the Centre's proposed research in downhole tubular products. Comprised primarily of Member companies, the Council meets regularly to provide guidance for and critical assessment of C-FER's various research initiatives.

The May meeting dealt with proposals put forward in response to a recent decision of the C-FER Board of Directors to considerably expand C-FER's research thrust in downhole tubular products. That decision reflects industry concern regarding the serious and costly problems downhole and the need for co-ordinated research in this area (see *Frontiers*, April 1985).

Guided by the advice of the Technical Council, C-FER has fleshed out several specific research projects for immediate attention.

The first of these is a finite element analysis of casing connections, a project designed to examine the behaviour of downhole tubular connections and to model various types of connections subject to thread interference during make-up and loading conditions encountered during service.

The project will involve the construction of an axisymmetric finite element model of various casing connections. Two principle types of loading will be incorporated into the model: internal loading resulting from interference between the box and pin component of the connections; and external loading consisting of internal or external pressure and axial loading of the connection. Since bending effects cannot be modelled as an axisymmetric problem, they will not be considered in the initial stage of this investigation.

Using the ADINA code, the finite element analysis will provide a comparison of the performance of various joint configurations. The effects on the stress and strain distributions of both varying interferences in the connections and varying loading conditions will be predicted, as will local effects on the threaded portion and pressure distributions over bearing surfaces. In addition to the insight provided into the connection performance, the results of the analysis will provide important information for a companion study in which an

Devonian Chairman Honoured by U of A

Donald Harvie, Chairman of the Board and Chief Executive Officer of the Devonian Group of Charitable Foundations, was awarded an honourary Doctor of Laws degree by the University of Alberta at Spring Convocation in June.

A native of Alberta and a graduate of the University of Alberta (BSc Chemical Engineering, 1945) and Harvard University (MBA, 1949), Dr. Harvie was cited for his imaginative leadership and his positive influence on the academic and business life of Canadian society.

The Devonian Group of Charitable Foundations was established in 1955 by Dr. Harvie's father, Eric Harvie. The Devonian Group places priority on projects in three areas: applied scientific research, historic preservation and museums; and public parks. C-FER and C-CORE, the Centre for Cold Ocean Resources Engineering, are among the many projects to benefit from the Devonian initiative.

In addition to his primary role as head of one of Canada's leading philanthropic organizations, Dr. Harvie is currently the senior director of the Glenbow-Alberta Institute and is director of several major national companies.

Donald Harvie

experimental investigation of casing connections will be performed.

This second research project will initially focus on tubular joint make-up connection tools. According to Maurice Slack, C-FER research engineer, connection make-up is recognized by industry as "possibly the weakest link in the chain of uncertainties" leading to tubular failure. The development of tools to better define the state of the joint at make-up is therefore in order, and the current C-FER project is intended as a preliminary feasibility study of several techniques that may be useful tools to evaluate the quality of a given make-up connection.

In the experimental investigation proposed by C-FER, testing will be done on a tubing connection with a torque shoulder sealing surface and buttress threads. The primary concern of the test is the measurement of the contact pressure on the sealing surface. To do this will involve four main steps: 1) strain gauges will be attached to appropriate locations on the coupling body and, using finite element analysis, will select strains most sensitive to sealing pressure; 2) make-up will be done incrementally with both torque and rotation recorded; 3) contact surface pressure will be measured directly at selected points by pressure-to-leakage through pin hole orifices; and 4) experimental acoustic shrink-fit pressure measurements will be attempted around the seal surface circumference. According to Mr. Slack, the plan is to obtain this data for three samples with three variations of taper tolerances: equal taper; fast pin/slow box; and slow pin/fast box.

The intent of this research project is to develop tools to indicate contact pressure directly. The next step will then be to correlate these measurements to connection leakage and, possibly, strength performance. If a statistically narrow correlation can be obtained, a useful field technique should follow.

Future research projects in the area of downhole tubular products will include tubing and sucker rod wear and an investigation of deviated casing connections. It is anticipated that the resulting bending loads will be evaluated for typical east coast and Alberta enhanced oil recovery environments.

C-FER Atlantic Increases Collaboration

C-FER and TUNS, the Technical University of Nova Scotia, have agreed to the formation of a joint research and networking initiative to be housed on the TUNS campus in Halifax, Nova Scotia.

C-FER Atlantic will officially open its doors on 1 September. Gerry Ewing, currently an Assistant Deputy Minister with the federal department of Fisheries and Oceans, has been named to direct the east-coast operation.

The formation of C-FER Atlantic will enhance C-FER's national presence. More importantly, says C-FER President Peter Adams, it will "pave the way for collaborative research oriented to the needs of Atlantic Canada's energy industry."

According to Clair Callaghan, President of TUNS, the agreement is an excellent example of technology transfer in action. "C-FER Atlantic provides another mechanism by which the intellectual strength of our staff can be applied to industry problems."

Continued on next page

Cover Photo

Three steel plates affixed to a CANMAR Arctic class supply vessel will provide important data for C-FER's welded plate project. The plates, each containing an experimental butt weld, were attached to the vessel in McKinley Bay this spring. Two of the plates, welded at room temperature, were attached to the hull at the waterline; the third, welded at −30°C, was attached to the ship below the surface. The collaborative effort will enable C-FER to examine the performance of the welds under actual service conditions. Data obtained will be compared to that of similar specimens which have been subject to lab tests designed to simulate field conditions.

Arrangements are currently being made to weld additional plates to Gulf's Molikpaq.

Photo courtesy of Dome Petroleum Ltd.

The initial focus of C-FER Atlantic vill be research in the area of lownhole tubular products. Problems lownhole are among the most langerous and costly facing the offshore petroleum industry, and esearch focussed in this area is of ritical importance to the safe and conomical development of Canada's rontier oil and gas resources.

Mr. Ewing has been seconded to -FER from the federal government or a two-year period. A professional ngineer of long standing, his varied esponsibilities include a five-year rm as Dominion Hydrographer and, ore recently, eight years as Assistant eputy Minister, Ocean Science and rveys, Department of Fisheries and eans.

C-FER Atlantic will operate under e policy direction of the C-FER oard of Directors. Its research programs will be congruent with those of C-FER's overall mandate, while recognizing the specific needs of the Atlantic region. Funding for the operation will mirror that of C-FER, with financial backing from the industrial, government and university communities of the east coast.

While C-FER Atlantic will not officially begin operation until September, some informal activity has already commenced. Two TUNS research engineers, Graeme Lee (centre) and Keith Leewis (right), have been reviewing design standards for casings. In addition, they attended the May meeting of the C-FER Technical Council and are actively seeking specific projects in which they can become involved on behalf of C-FER Atlantic. In discussion with them at the Technical Council meeting is Dave Fleming of Shell Canada.

nformation Specialists Gather

ore than 60 information specialists, rarians and end users gathered in lgary recently for Northern and fshore Information Resources, a rkshop sponsored by C-FER and Arctic Institute of North America. Registrants came from across nada and the United States to cuss a variety of issues relating to ilable resources and methods of proving retrieval and semination of information on thern and offshore regions. The morning session provided egates with an overview of rently available resources. resentative centres and systems e highlighted and an overview of itional resources was presented.

The afternoon session was designed as a user forum. Key resource leaders facilitated a productive idea exchange covering a wide range of topics including user needs, access problems and information gaps.

A.E. Pallister, President, Pallister Resource Management Ltd., spoke to the group at noon on the need for an international Arctic information system.

Of the many views expressed during the workshop, perhaps the most prevalent was the need for more knowledge about the systems now available and the ways in which they interrelate. Information brokers and end users agreed that the publication of a guide to such resources would be most beneficial, but concern was raised regarding the preparation, funding and distribution of such a resource.

The group also agreed that a collaborative effort on the part of information providers would help to strengthen an effective marketing approach. The primary value of the workshop was identified as the opportunity it provided for dialogue between information brokers and end users. It was suggested that similar workshops be held in other locations in Canada.

Summary proceedings of Northern and Offshore Information Resources will appear in the October issue of *Frontiers*.

IMD to Open in November

A two-day symposium on Arctic vessel research will be held in conjunction with the official opening of the National Research Council's multi-million dollar Institute for Marine Dynamics (IMD) in St. John's, Newfoundland.

The symposium will feature 12 invited speakers. Confirmed to date are K.R. Croasdale, K.R. Croasdale & Associates; G. Frankenstein, U.S. Army CRREL; A. Keinonen, CANMAR; B.J. Michel, Univeriste Laval; R. Peters, Memorial University; J. Schwarz, Hamburgische Schiffbau-Versuchsanstalt; G. Vance, Mobil Oil Canada; and L.W. Gold, S.J. Jones and G.W. Timco, National Research Council of Canada.

The twelve talks will form three half-day sessions; the fourth half-day will be devoted to the official opening of the facility.

IMD features three major laboratory facilities: an 80-meter ice tank designed for experiments in ice of controlled characteristics to simulate the Arctic marine environment; a 200-meter clear water towing tank which will permit significant hydrodynamic investigations; and a 75-meter wave tank designed for a wide range of wave spectra and short-crested sea investigations.

The official opening of IMD will be held on Tuesday, 5 November; the symposium will take place on the 5th and 6th. The cost of the symposium is $50.00. More information on the symposium and opening may be obtained by contacting IMD, telephone (709) 772-2479.

Attention Readers!

One of the tenets of the C-FER Network is that it is made up of people, individual experts not "anonymous" titles. It is this person-to-person orientation that makes the Network an effective communication tool. In order to be effective, we need to keep our mailing list as current and as accurate as possible. And to do that, we need your help.

Enclosed with this issue of *Frontiers*, therefore, is an update form. Please assist us by reviewing your listing and returning the form to us with any necessary corrections. And while you're at it, please include the names of others in your organization who would benefit from becoming C-FER Network members.

We would appreciate your help on another front as well. Since we are always looking for ways of making our newsletters more effective, any comments you might have regarding the format or the content of either *Frontiers* or *Networker* would be most appreciated. More specifically, we would welcome your suggestions regarding projects or technical topics of interest to those in Arctic and offshore related industries.

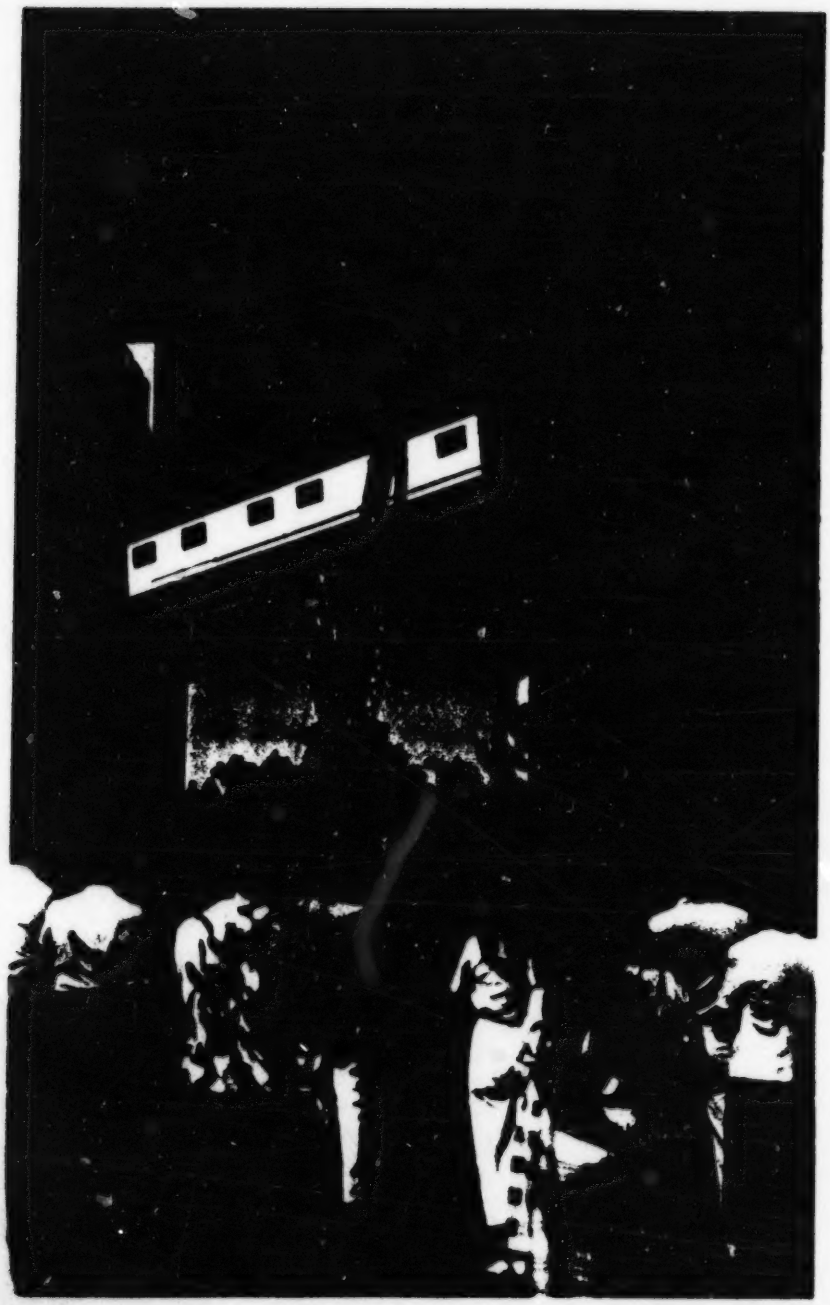
Drop us a line or give us a call: C-FER, Building 7A, University of Alberta Campus, Edmonton, Alberta T6G 2E2. Telephone (403) 432-5108.

AOTC Set for September

A limited number of seats are still available on a special charter flight from Calgary to Anchorage for the 1985 Arctic Offshore Technology Conference (AOTC) scheduled for 3 to 5 September in Anchorage, Alaska.

Held in conjunction with the 19th Annual Alaska Oil, Gas and Mining Industry Show, AOTC will focus specifically on practical and operational concerns in the Arctic and offshore areas of Canada and Alaska. The conference will highlight state-of-the-art drilling and ice technology and the increasing importance of marine support and transportation systems. It will examine the operation of structures in ice-infested waters, analyze the impact of ice on both exploration and production, and look at various aspects of safety in the Arctic and offshore environment.

The charter flight will leave Calgary on the evening of Monday, 2 September and will return on Friday the 6th. The fare for the 3½ hour flight is $750.00 return. Flight reservations and conference details may be obtained by contacting Dorinda Wong, AOTC Conference Administrator, telephone (403) 242-2488.



C-FER, it could be said, is going up in the world! Since opening its doors some 15 months ago, C-FER has grown from 2 to 17 full time staff, a tight squeeze indeed for the small building it currently occupies on the University of Alberta campus. With overcrowding fast becoming a real problem, the University has come up with a viable, albeit unusual, solution . . . the addition of two ATCO trailers on top of nearby Windsor Car Park. Never let it be said that C-FER is adverse to raising its profile!

Private Support Critical

The importance of private sector support for C-FER was high on the list of items discussed at the most recent meeting of the C-FER Board of Directors, held on Tuesday, 18 June, in Edmonton, Alberta.

The discussion regarding financial support for C-FER was substantive and wide-ranging, with funding accountability, membership categories, foreign membership and information disclosure among the items discussed.

A suggestion was made that Member contributions be accepted on a "project-specific" basis. Such a procedure would be a marked shift in the Centre's overall philosophy and considerable discussion resulted. In the end, the Board agreed that the allocation of C-FER funds should continue as before, with all but contract funds directed to the Centre's core research programs and to its networking initiatives. Should a Member company have a specific interest in research of a proprietary nature, that research may be carried out under contract to the Member company in question.

The Board also approved in principle the concept of a special category of membership for affiliated research centres. Details of the concept have yet to be finalized, but the intent of the proposal is to facilitate increased dialogue with other research centres to mutual benefit.

A major issue to receive the attention of the Board was the question of foreign membership. After extensive discussion, it was agreed that, in order to enhance C-FER's role

as an international centre of excellence, membership in C-FER be open to a select group of foreign companies on condition that such membership involve reciprocal and on-going technology transfer. In all such cases, approval of membership will rest with the Board of Directors.

Of particular importance was the question of ensuring C-FER's long-term stability. While recognizing that major contributions from the Devonian Group of Charitable Foundations, the Governments of Alberta and Canada and the University of Alberta have provided C-FER with a firm foundation on which to build, the Board was unanimous in its view that the Centre's long-term viability relies on the solid financial backing and membership support of Canada's private sector.

"The challenge facing us during the next year will be to increase our private sector support," said Bill Grundy, Chairman of the C-FER Membership Committee. "It is that clear-cut commitment that will ensure that we continue to thrive as a world-class centre of excellence."

Another major item for discussion at the June meeting was the report of the Research Policy Committee. Presented by Murray Todd, Dome Petroleum, the report reviewed the progress of C-FER's three main research programs.

The next meeting of the Board of Directors will be held in Ottawa on Tuesday, 22 October, 1985.

C-FER Members

Algoma Steel Corporation, Limited
AMCA International
Bow Valley Industries Ltd.
Canadian Fracmaster Ltd.
Devonian Group of Charitable Foundations
Dome Petroleum Limited
Government of Alberta
Government of Canada
Gulf Canada Resources Inc.
Hanson Materials Engineering (Alberta) Ltd.
NOVA, An Alberta Corporation
Stanley Associates Engineering Ltd.
Geico Inc.
University of Alberta
Viatec Resource Systems Inc.

Membership Benefits

- direct access to C-FER research staff
- advance knowledge of research in progress and preliminary and final results
- membership on the C-FER Technical Council (a panel of industry experts who provide guidance for and critical assessment of specific research projects) and on its project committees.
- eligibility for membership on the C-FER Board of Directors and its various standing committees
- exclusive access to C-FER for the purposes of contract research
- preferred consideration at such time as C-FER subcontracts portions of its research projects or refers specific projects to external sources
- priority access to C-FER's information services
- access to all C-FER publications including confidential reports, technical papers (at reduced cost) and newsletters
- preferred cost and registration at all C-FER sponsored workshops, seminars, and conferences.

CFER

Centre for Empirical Forensic Research

Centre for Frontier Engineering Research

Networker

A monthly update

May 1985

Technical experts from Canada's major oil companies, engineering consulting firms and steel makers gathered in Calgary earlier this month for the second meeting of the C-FER Technical Council. The Council is a panel of industry experts who provide guidance for and critical assessment of C-FER's research initiatives. The focus of the meeting was C-FER's proposed research into downhole tubular components. Companies represented at the meeting included Algoma Steel; AMCA International; CanOcean Resources; Dome Petroleum; Esso Resources; Gulf Canada Resources; Hanson Materials; Mobil Oil; NOVA, An Alberta Corporation; Petro-Canada; Shell Canada; Stanley Associates; Stelco; and Viatec Resources. Representatives of the University of Alberta and the Technical University of Nova Scotia also took part in the meeting.

Information was the order of the day on Thursday, 2 May when more than 60 information specialists, librarians and end users gathered in Calgary for a day-long workshop on Northern and Offshore Information Resources. The workshop, sponsored by C-FER and the Arctic Institute of North America, drew representatives from across Canada and the United States to discuss methods of information retrieval and dissemination and to explore ways of effecting increased dialogue between information brokers and end users.

Transport Canada has recently released its Review of Transport Canada Icebreaking Trials, 1969-1984. The synopsis reflects the research of the Canadian Coast Guard, the Transportation Development Centre, Canarctic Shipping, and the government's joint cooperation with industry and other governments. The intent of the publication is to promote an awareness of the breadth of the Canadian knowledge base and reports on the results of the trials may be made available upon request. Requests for hard data, formulae and other sensitive information will be governed by the policies of the Marine Administration for the promotion of Canadian benefits. For more information, contact the Marine Administration, Transport Canada, Ottawa, Ontario K1A ON7, telephone (613) 995 7324.

Moving: As of 1 June, 1985 the Transportation Development Centre (TDC) will have a new address: Complexe Guy Favreau, 200 Dorchester Blvd West, Suite 601, West Tower, Montreal, Quebec H2Z 1X4.

C-FER

Viatec Resource Systems Inc. is the most recent addition to the C-FER list of supporters. Membership in C-FER provides a wide range of benefits including direct access to C-FER's research staff; active participation in its Technical Council; priority access to all research reports; and preferred cost at all C-FER sponsored workshops and seminars. Other C-FER Members are Algoma Steel; AMCA International; Bow Valley Industries; CanOcean Resources; Devonian Group of Charitable Foundations; Dome Petroleum; Government of Alberta; Government of Canada; Gulf Canada Resources; Hanson Materials; NOVA, An Alberta Corporation; Stanley Associates; Stelco Inc.; and the University of Alberta.

September 3 - 5 are the dates of this year's Arctic Offshore Technology Conference, to be held in conjunction with the 19th Annual Alaska Oil, Gas and Mining Industry Show in Anchorage, Alaska. The emphasis of the conference will be on the latest in developments in the oil industry as it moves toward production in Canada's Beaufort Sea and increased wildcat activity offshore Alaska. Industry experts from Canada and the United States will expand on the papers given at the 1984 AOTC, held in Calgary last November. Limited sets of 1984 AOTC Proceedings are still available, at a cost of $320. For more information, contact AOTC, #101, 3009 23 Avenue S.W., Calgary, Alberta T3E 0J3, telephone (403) 242 4288.

Recommended reading: CPA Review, March 1985, published by the Canadian Petroleum Association. Says Arne Nielsen, Chairman of the CPA, "Communication is one of the biggest jobs industry associations have to do, and in my view it's likely to be even more important in the years ahead." To that end, the 9th edition of the CPA Review offers a broad overview of technical information about the petroleum industry geared to a wide and varied audience. In addition, the CPA Review puts out a call for comment. "Your thoughts could help us lay the groundwork for communication that includes messages travelling both ways down the road," says Mr. Nielsen. Comments should be addressed to the CPA Review, 1500, 633 Sixth Avenue S.W., Calgary, Alberta T2P 2Y5.

The Centre for Frontier Engineering Research was established in late 1983 to address problems related to materials, design and construction for arctic and offshore resource development. *Networker* is published regularly by C-FER. Information of interest to its readership should be sent to:

Liz Clarke
Information Officer (403-432-5108)
Centre for Frontier Engineering Research
Building 7A
University of Alberta Campus
Edmonton, Alberta, Canada
T6G 2E2

CFER

APPENDIX C

NETWORKING WORKSHOPS

APPENDIX C

NETWORKING WORKSHOPS

Survivability Limit State-Design Concepts and Environmental Loads
Vancouver, British Columbia; January 1985.

Discussions among a small group of structural specialists centred on damage to steel plate in ice-resisting walls; what deformations actually impaired serviceability and functionality.

Steels Fabricated for Low Temperature Services
Toronto, Ontario; January 1985.

Shipbuilders, steel makers and welding consumable suppliers gathered in Toronto for a one-day invitational workshop sponsored by C-FER and the Welding Institute of Canada (WIC). The purpose of the workshop was to assist Canadian industry in preparing to meet the unique challenges presented by the use of steel specially formulated for low temperatures.

Presentations by representatives of Algoma, Stelco, WIC, Dominion Bridge and Canadian Liquid Air focussed on current practices and recent developments in industry. Participants spent considerable time defining common problems and searching for possible solutions. The discussion was wide-ranging, with participants agreeing on numerous issues including the critical need for the development of Canadian offshore standards and the importance of sharing information on technical developments as forthrightly as practical.

Requirements for C-FER Tubular Products Lab
Calgary, Alberta; April 1985

Half a dozen senior drilling engineers were gathered to advise on normal and extreme service loads to which casing and drill pipe are subjected. Comments were also given on specific types of testing and research that would be most useful to the operating companies.

Northern and Offshore Information Resources
Calgary, Alberta; May 1985
Ottawa, Ontario; October 1985.

C-FER and the Arctic Institute of North America (AINA) jointly sponsored both workshops; Indian and Northern Affairs Canada assisted in arranging the second. The purpose of the workshops was to enhance dialogue between information brokers and

end-users. Representatives from numerous information services involved in Canada's frontiers discussed existing information systems, new trends in information retrieval and dissemination, and methods of effective cooperation. An important focus of the day-long workshops was the clarification of user needs and direction regarding the various systems available.

C-FER - UNIVERSITY OF ALBERTA

OFFSHORE STRUCTURAL ENGINEERING

JANUARY 15	**"ARCTIC AND OFFSHORE PRODUCTION STRUCTURES"** Mr. R. Pan Senior Advisor Frontier Development Gulf Canada Resources
JANUARY 22	**"DESIGN OF DOME'S ARCTIC OFFSHORE STRUCTURES"** Mr. J. Fitzpatrick Staff Engineer - Structural Engineering & Production Dept. Dome Petroleum Limited
JANUARY 29	**"WELDING, METALLURGICAL AND CORROSION CONSIDERATIONS FOR OFFSHORE STRUCTURES"** Mr. P. Blakesley Metallurgical Coordinator C-FER
FEBRUARY 5	**"ICE LOADING ON OFFSHORE STRUCTURES"** Mr. K. Croasdale President K. Croasdale & Associates
FEBRUARY 12	**"WIND AND WAVE CLIMATES FOR OFFSHORE STRUCTURES"** Dr. A. Davenport Director, Boundary Layer Wind Tunnel Laboratory Faculty of Engineering Science University of Western Ontario
FEBRUARY 19	READING WEEK
FEBRUARY 26	**"FOUNDATION CONSIDERATIONS FOR OFFSHORE STRUCTURES"** Mr. D. Haley Vice President EBA Engineering Consultants Ltd.

MARCH 5 **"ESSO'S CAISSON RETAINED ISLAND"**
Mr. M. Comyn
Naval Architect
Drilling Operations
Esso Resources Canada Limited

MARCH 12 **"RESEARCH TO SUPPORT OFFSHORE STRUCTURE DESIGN"**
Mr. T. Marion
Section Head
Materials Technology
Esso Resources Canada Limited
Research Department

MARCH 19 **"DESIGN PROCEDURES FOR OFFSHORE STRUCTURES"**
Mr. D. Andrews
Vice President
Tri-Ocean Engineering Ltd.

MARCH 26 **"CONSTRUCTION PROCEDURES FOR THE ARCTIC"**
Mr. D. Stenning
President
Arctic Offshore Engineering Ltd.

APRIL 2 **"DESIGN OF BOW VALLEY'S MAI"**
Mr. K. Pullerits
Partner
Albery, Pullerits, Dickson and Associates

APRIL 9 **"PROSPECTS FOR ARCTIC DEVELOPMENT"**
Dr. A.E. Pallister
President
Pallister Resource Management Ltd.

APPENDIX D

LIBRARY LISTING

TITLE Ice-structure interaction of an offshore platform

AUTHOR Powell, G.; Schricker, V.; Row, D.; Hollings, J.; Sause, R..

SOURCE Proceeding of the Conference Arctic '85 : Civil Engineering in the Arctic Offshore, March 25-27, 1985, San Francisco, California. - New York. : ASCE, 1985, [p. 230-238], ill. References.

LOCATION C-FER C00002

SUBJECT CIVIL ENGINEERING. ARCTIC. OFFSHORE

ANNOTATION Realistic estimation of the effects of ice floe impact is desirable for the design of certain subarctic offshore structures. The results of a preliminary study on dynamic ice-structure impact are described, for a large ice floe striking a tubular steel platform. The ice is modeled taking into account strain rate effects. A simplified model is used for the platform stucture, to reduce computational effort. Comparisons are made of the results obtained from both static and dynamic analyses. It is concluded that the static and dynamic results can generally not be correlated, and hence that the dynamic analysis is desirable.

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TITLE Iceberg interactions with offshore structures

AUTHOR de St. O. Isaacson, M..

SOURCE Proceedings of the Conference Arctic '85 : Civil Engineering in the Arctic Offshore, March 25-27, 1985, San Francisco, California. - New York. : ASCE, 1985, [p. 276-285], ill. References.

LOCATION C-FER C00002

SUBJECT CIVIL ENGINEERING. ARCTIC. OFFSHORE

ANNOTATION This paper reviews various aspects of the general problem of iceberg interaction with offshore structures. This includes the component problems corresponding to iceberg drift in open water, wave-induced motions of a berg, and the impact of an iceberg with an offshore structure. For smaller ice masses,

the effect of a large structure on the berg's trajectory, as well as the wave-induced motions of a berg, both are important problems which have received relatively little attention. The greatest difficulties in force and motion predictions are due to uncertainties in iceberg configurations and in ice properties, rather than due to the simulation of the physical processes involved.

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TITLE Icebreakers: Labrador, Ikaluk and sister ship Miscaroo, d'Iberville, Norman McLeod Rogers, John Cabot

AUTHOR Anon.

SOURCE Anon

LOCATION C-FER E00025

SUBJECT SHIPS. VESSELS. SPECIFICATIONS. LABRADOR. IKALUK. MISCAROO. D'IBERVILLE. NORMAN MCLEOD ROGERS. JOHN CABOT. ICEBREAKERS

ANNOTATION This reprint is a combination of various pages describing the various icebreakers with the following information shown for each: displacement, measurement, dimensions, aircraft, main engine, builders, date commissioned and some have photographs.

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TITLE Implications of ice ridges and rubble fields on the design of arctic offshore structures

AUTHOR Croasdale, K.R..

SOURCE Workshop on Sea Ice Ridging & Pile-Up, October 22-24, 1980, Calgary, Alberta. : NRC Tech. Memo 134, figures, tables. References.

LOCATION C-FER E00030

SUBJECT ICE RIDGES. ICE RUBBLE. OFFSHORE. STRUCTURES. DESIGN

ANNOTATION This paper reviews how ice ridges and ice rubble fields can affect ice forces on offshroe structures. The mechanism of ridge building as a limiting force is also reviewed. For narrow structures, it is suggested that thick multi-year ridges will govern the maximum ice forces. For wide

structures, the presence of a rubble field can have a major influence on ice/structure interaction especially if it becomes grouned. For large structures subject to collision by extremely ridge building behind the large feature may limit the maximum forces on the structure.

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TITLE Improving Arctic seafloor soil stability

AUTHOR Mitchell, J.K..

SOURCE Proceedings of the Conference Arctic '85 : Civil Engineering in the Arctic Offshore, March 25-27, 1985, San Francisco, California. - New York. : ASCE, 1985, [p. 1084-1092], ill. References.

LOCATION C-FER C00002

SUBJECT CIVIL ENGINEERING. ARCTIC. OFFSHORE

ANNOTATION Soft, low strength soil layers at or beneath the Beaufort seafloor mean that soil strengthening may be necessary to ensure the stability of oil exploration and production structures under the action of horizontal ice loading. Preliminary studies have been made to evaluate the suitablility of several methods for strengthening fine-grained soils characteristic of those found in the Arctic. Of the methods studied, vertical drains, freezing, in situ mixing of admixtures, particularly cement, and special types of grouting are potentially applicable. Special techniques will be needed to facilitate the use of these methods below water.

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TITLE In situ state of underwater hydraulic sand fills

AUTHOR Crooks, J.H.A.; Shinder, S.B.; Been, K..

SOURCE Proceedings of the Conference Arctic '85 : Civil Engineering in the Arctic Offshore, March 25-27, 1985, San Francisco, California. - New York. : ASCE, 1985, [p. 84-92], ill. References.

LOCATION C-FER C00002

SUBJECT CIVIL ENGINEERING. ARTIC. OFFSHORE

APPENDIX E

PROJECT REPORTING

CENTRE FOR FRONTIER ENGINEERING RESEARCH

PROJECT RATIONALE

PROJECT: DESIGN AND BEHAVIOR OF COMPOSITE ICE-RESISTING WALLS NUMBER: 85-09

[X] INITIAL RATIONALE STATEMENT [ ] REVISED STATEMENT

The exterior walls of arctic oil and gas production structures will be subject to large, concentrated ice forces. Composite, steel/concrete sandwich walls have been proposed as a cost-effective solution to resisting these forces.

The research proposed here will investigate the behavior and failure mechanisms of composite walls, so that recommendations can be made concerning analysis and design methods, effective construction details and optimum sizes of members. The research will involve the development of design-oriented ultimate strength and finite element models, as well as the physical testing of representative, composite wall specimens.

PREPARED BY: Tom Zimmerman DATE: Aug. 30, 1985

CENTRE FOR FRONTIER ENGINEERING RESEARCH

PROJECT OBJECTIVES

PROJECT: DESIGN AND BEHAVIOR OF COMPOSITE ICE-RESISTING WALLS NUMBER: 85-09

[X] INITIAL STATEMENT OF OBJECTIVES [ ] REVISED OBJECTIVES

The overall objective of this research is to produce tools to enable a designer to predict the behavior and ultimate strength of composite ice-resisting walls and to make recommendations concerning optimum sizes and structural details.

Preliminary Design Studies

A series of preliminary design studies will be undertaken to establish a suitable design method and to determine what member sizes, materials and structural details will be considered. The design studies will develop an ultimate strength approach, similar to that on which structural steel and reinforced concrete design is based. Physical testing will be used to evaluate the validity of the design method and to refine or adjust it as required.

Inelastic Finite Element Model

One key design tool which will be developed is an inelastic finite element model to predict the complete load-deflection behavior of a composite wall. Two existing finite element programs, ABAQUS and ADINA, will be evaluated for suitability in constructing the model and for ease of use in the design process. Physical testing will be used to verify and refine the finite element model. The final product will be a design-oriented analysis tool.

Design Recommendations

The results of the research will be used to prepare recommendations concerning optimum span-to-depth ratios, steel plate thicknesses, methods of shear transfer and various structural details. These recommendations, which will allow for efficient and cost-effective use of composite walls, are the major objective of this research.

PREPARED BY: Tom Zimmerman DATE: Aug. 30, 1985

CENTRE FOR FRONTIER ENGINEERING RESEARCH

PROJECT MONTHLY REPORT

AUGUST, 1985

DESIGN AND BEHAVIOR OF COMPOSITE ICE-RESISTING WALLS

Preliminary design studies are underway to establish a suitable design method. The "compression field theory" approach being taken is similar to that recently introduced (CSA A23.3-M84) in the design of reinforced concrete, deep beams. Important parameters which the design studies have identified include:

- Method of shear connection;
- Bulkhead support details;
- Lateral confinement and end restraint provided by the surrounding structure;
- Span-to-depth ratio.

Physical tests on 1/4 scale specimens are now being planned to evaluate the above parameters. The test frame, which is currently being designed will have the capacity to apply a total load of almost 1.8 million pounds (8.0 million Newtons) to the test specimens.

PREPARED BY: T. Zimmerman DATE: Aug. 30/85 PROJECT NO. 85-09

FOR MORE INFORMATION PLEASE CONTACT THE C-FER PROJECT OFFICER, Tom Zimmerman, AT 403 432-5108.

CENTRE FOR FRONTIER ENGINEERING RESEARCH
PROJECT MONTHLY REPORT
SEPTEMBER, 1985
DESIGN AND BEHAVIOR OF COMPOSITE ICE-RESISTING WALLS

Preliminary Design Study

A recent paper entitled "On the Ultimate Strength of Composite Steel-Concrete Structure", by Hattori, Ishihama, et al, has been reviewed. This paper, which was presented at the POAC '85 conference, reports on a test program, conducted in Japan, which tested composite beam-type specimens of approximately a 3 to 1 span-to-depth ratio. One specimen (approximately 1/4 scale), spanning 1000 mm, is reported capable of carrying a midspan load of 20 MPa distributed over an area 200 x 200. The authors of this paper achieve good results using a method, similar to the "compression field theory" approach which C-FER is taking, to compute the ultimate capacity of the composite member.

In addition to the items listed in last month's report, the design study has identified "amount of shear reinforcement" as another important parameter. It is felt that shear reinforcing principally adds ductility to the wall, but also increases the fabrication cost. The amount of ductility required is debatable.

Finite Element Analysis

Work has begun using the inelastic finite element program ADINA. The initial work will be an effort to correctly predict the behaviour of the specimens reported on in the above mentioned paper.

Physical Tests

The initial test series being designed will consist of specimens, 375 wide, which will vary in depth from 150 to 300. They will be continuous over a 1250 span, and will be loaded at 8 load points which are intended to approximate a UDL. Span-to-depth ratios between 4 and 8 will be investigated. Specimen details will vary in order to study the effects of lateral confinement, end restraint, shear reinforcing, shear connection and bulkhead support details. The specimens will be designed to carry a load of 3 to 4 MPa.

A second test series being planned will look at another potentially critical load case; a high concentrated load over a small area. For these tests, slab-type specimens (which allow a 3-dimensional arch to form) will be used.

PREPARED BY: T. Zimmerman DATE: Oct. 7/85 PROJECT NO. 85-09

FOR MORE INFORMATION PLEASE CONTACT THE C-FER PROJECT OFFICER, Tom Zimmerman, AT 403 432-5108.

APPENDIX F

PHASE II GOALS AND OBJECTIVES

APPENDIX F

CENTRE FOR FRONTIER ENGINEERING RESEARCH
NETWORKING PROGRAM

PHASE II GOALS AND OBJECTIVES

INDUSTRY CONTACTS

Goals - Continuing

Continue maintenance contacts with existing Network List.

Visit 10 organizations per month	Monthly

Goals - Phase II

Increase contacts with Downhole Tubulars organizations.

Visit 10 new organizations per month	Monthly

Develop CSIRA or AOSTRA type program of Networking mini-contracts.

For approval	85 12 31
Implement	86 01 31

Develop client service package for each level of Network contacts.

Finalized	85 12 31
Initiate on site briefings for C-FER Members	86 01 31

Identify and recruit technical committee chairman into Network.

Introductory letter sent	86 02 28
Initiate ongoing contacts	86 04 30

Establish formal links with other research organizations.

Introductory letters sent	85 10 01
Arrangements finalized with AINA/C-CORE/ WIC/SINT/BOREAL	86 02 28

PUBLICATIONS

Goals - Continuing

Continue newsletters and Annual Report.

Implement modifications in content, format	86 01 01
Regularize mailing date - 2nd Thursday of each month	Monthly
Debriefing and formal review of Annual Report and Frontiers format	85 11 15

Update C-FER Brochure.

Draft format for approval	85 11 30
Draft of text for approval	85 12 31
Published	86 01 31

Goals - Phase II

Enhance C-FER visibility as a focal point in information transfer for frontier industries.

Submit article to technical press on C-FER program(s) every three months	Quarterly

WORKSHOPS

Goals - Continuing

Continue "Participant-Led" workshops.

Continue "Northern and Offshore Information Resources" series in Atlantic Canada and Northwest Territories	Jan/86 Apr/86

Continue "Technical" workshops at one year intervals (Note: Target is two workshops annually, either participant or expert led)

Continue university courses - one per academic year.

Bring in selected speakers in Downhole Tubulars (casing design) over spring term — 86 01 01

Goals - Phase II

Initiate "expert-led" workshops - at one year intervals.

Initiate first workshop (Note: Target is two workshops annually, either expert or participant led) — Sept/86-May/87

INFORMATION SERVICE

Goals - Continuing

Update C-FER Display.

Draft format/content for approval — 85 11 30

Updated — 86 02 28

Goals - Phase II

Enhance C-FER visibility as a focal point in information transfer for frontier industries.

Achieve higher utilization of display: place at four major conferences in 1986 (3 Structures, 1 Tubulars).

Seek four major speaking engagements per year with quasitechnical groups in various cities across Canada.

Make arrangements for "librarian" capability on C-FER staff.

Decision on type of arrangement — 85 11 15

Capability on staff	86 01 01
Establish research reporting system for C-FER projects.	
Implement for all projects	86 01 15
Usefulness questionnaire, review frequency	86 03 31
Develop an overview of frontier-related industries and technologies.	
Upgrade S.O.I. paper - frontiers descriptions, history and industries sections	86 03 31